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Original Article

A self-efficacy–based educational intervention to promote physical activity and healthy eating among adolescents

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Abstract:
Introduction and purpose: Improving adolescents' self-efficacy were crucial for improving physical activity and healthy eating habits. Self-efficacy is based on health behaviors, which are based on their beliefs and abilities to maintain healthy behaviors. Current national and global data trends over the past 10 years have shown a decline in physical activity and healthy eating habits, which may ultimately impact the risk of degenerative diseases.This study evaluated the effectiveness of a health behavior change based intervention program designed to improve adolescents self-efficacy regarding physical activity and healthy eating. **Methodology:** A total of 378 adolescents (189=117 female, 72 male), participated in the study. The intervention group received a self-efficacy-based educational program promoting physical activity and healthy eating for 12 weeks. All participants were assessed before and after program. The remaining 189 adolescents were assigned to the control group for the same 12 weeks period. Independent t-test and Mann Whitney were used to compare baseline differences, paired sample T Test) is used to compare the pre-and post-intervention pairs in the control and treatment groups, and Cohen's D analysis to quantify the effect size in both groups. **Results:** All variables experienced an increase in the posttest compared to the pretest with effect sizes ranging from 2.17 for self-efficacy related to physical activity. On the other hand, the control group also showed an increase from pretest to posttest in the physical activity variable (ES = 0.45), an increase in self-efficacy related to physical activity (ES = 0.30). However, the increase in these variables in the control group was smaller than the increase in the treatment group, namely 2.17 in physical activity. **Conclution:** It can be concluded that improvements occurred in more variables and with a larger effect size in the intervention group compared to the without intervention group.
Keywords: adolescents, healthy eating, physical activity, self-efficacy

Introduction

The World Health Organization (WHO) states that adolescence begins in the second decade of life. According to WHO data from 2019 and 2020, the number of adolescents with higher body weight in Asia has increased by 56 million (WHO, 2020). According to the data, there was a 49 million increase in obesity cases among adolescents between 2019 and 2020 (WHO, 2020; WHO, 2019). This trend of increasing weight problems among adolescents is also observed in Indonesia. Data shown that from 2013 to 2018, the physical activity of teenagers in the less-than-ideal category increased from 26.1 to 33.5% (Ministry of Health, R.I. 2013; Widyastuti, et al., 2024). This lack of physical exercise affects both male and female teenagers, with 78% males and 84% females. Adolescents' lack of physical exercise can be found in industrialized and developing countries, including Indonesia (WHO, 2020). In addition to the decrease in physical activity among adolescents, there is a shift in their dietary patterns (Widyastuti, et al., 2024). During this stage, adolescents begin to experience a shift in eating habits that were previously dominated by food provided by parents at home to frequently consuming food from outside the home that is higher in calories from processed food, fast food, and junk food, and low in fiber (Ministry of Health, R.I, 2018), (Mohammadbeigi et al., 2018). Adolescence, or the period between childhood and maturity, is when health behaviors are created and solidified. A healthy lifestyle is thus necessary for adolescents' normal development and progress. Furthermore, focusing on adolescent health behavior-shaping intervention activities influences adult illness burden, resulting in enhanced health through the "ripple effect" (Zhao et al., 2024; Varmazyar et al., 2024). For nearly 40 years, WHO's cross-sectional Health Behavior in School-aged Children (HBSC) research in Europe and Canada has continuously highlighted severe concerns and the most susceptible categories of teenagers (WHO, 2018).

Adolescents remain unstable, thus they require techniques to attain healthy behavior (Agyepong et al., 2024). According to international data from the HBSC research.[9] three-quarters of 15-year-old teenagers believe they are too fat, and 14% are adolescents with higher body weight. Furthermore, females aged 15 do not eat fruit and vegetables (61%) or breakfast on school days (52%), but they do consume sweets (28%) and sweet carbonated drinks (15%) on a daily basis. Less than 11% of them meet the recommendations for moderate-to-intense physical activity. Programs to prevent childhood and adolescents with higher body weight have been

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demonstrated to be ineffective, as evidenced by comprehensive studies of intervention programs (Lan et al., 2024). and guidelines (Warraitch et al., 2024). Children under the age of 12 exhibited low efficacy from these programs, whereas young people aged 13 to 18 had no reduction in BMI as a result of treatment implementation. Unfortunately, there has been little research on this age group. As a result, establishing a reliable assessment of the intervention's effectiveness is difficult (Achak et al., 2024). Health-related behaviors are linked together, and in many circumstances, a wide range of consolidated behavioral patterns can be observed (Vakili, et al., 2023). Systematic reviews shown that therapies aimed at increasing moderate-to-vigorous physical activity also have an effect on supporting other health-related behaviors, such as weight management or healthy eating (Li et al., 2021; Muhammad et al., 2024).

According to meta-analyses (Darfour, et al., 2018; Dougkas et al., 2019), school-based treatments that include physical exercise and healthy food can help prevent adolescents with higher body weight in the long run. These same research indicate that educational interventions have a fairly beneficial effect on modifying eating habits (Angelino et al., 2019). The employment of more applied behavioral modification methods and longer-term therapies has been connected to better intervention effects (Angelino et al., 2019; Whatnall et al., 2021; McHale, et al., 2022; Tirman et al., 2021). The intervention's use of self-regulation-focused behavioral change techniques was effective in changing participants' eating and exercise behaviors (Watson et al., 2021). Watson et al. (2019) conducted studies on youths (Watson et al., 2021; Scott, et al., 2023). Scott et al. (2023), in investigations involving adolescents, both confirmed this connection (Scott, et al., 2023). Furthermore, while only a few studies show long-term stability of the effect, others have demonstrated the efficacy of interactive modern media treatments in enhancing teens' diet and physical activity (Rose et al., 2017). Acquiring the requisite skills to begin activities in accordance with gained knowledge is required for effective behavior modification. Furthermore, it is highly sensitive to the context of the environment (Teixeira et al., 2018). Self-efficacy, which has been linked to motivation, behavior control, and goal achievement, is one of the human competences needed to successfully execute changes in health behavior (Cheng et al., 2024). If a person believes in their own efficacy, they can initiate and sustain change even in the face of new obstacles (Pietrabissa et al., 2020). So far, the efficacy of the Healthy program has been assessed throughout the full study group, without distinguishing between girls with excess body weight and those who do not (Morais et al., 2021).

Efforts made so far to improve public health by promoting a balanced nutritional menu, but are intended for the general public, while efforts to overcome overweight in adolescents based on self-efficacy in physical activity education and healthy eating habits are still missing. Behavior improvement programs based on self-efficacy of physical activity and healthy eating habits are prevention strategies aimed at all school adolescents (Sultana et al., 2023). So far, adolescents with excess weight to improve their health use universal programs. The purpose of this study was to determine how successfully adolescents aged 11 to 18 years responded to an intervention program aimed at increasing self-efficacy of physical activity and healthy eating habits.

Materials & Methods

Participants

The results were obtained using cluster randomization by school and repeated measures in a randomized field trial. The sample size was based on the estimated effect size of 0,8 following the finding from a preliminary study conducted in a similar population (Rose et al., 2017). The sample size calculation was calculated using the G*Power software and set significance level 0.05, power level 80% (two-tail hypothesis assumption) and resulted 343 participants. Anticipating a dropout rate of 10%, 378 were recruited. The Healthy program, included 378 male and female adolescents. Adolescents aged 15 ± 2 years, ranging from 11-18, were randomly picked from 16 high schools in Indonesia, primarily on Java Island. Interventions were divided into two types: intervention groups and non-intervention groups. The intervention group consisted of 8 schools, 117 female and 72 male adolescents, while the control group consisted of 8 schools, 117 female and 72 male adolescents. The intervention activities were separated into four topic phases: risk behavior, eating behavior, risk behavior, and personal and social competence, with the primary goal of increasing physical activity and eating habits. The multicomponent intervention was performed using a combination of techniques and mobile technology (12 items per week via a dedicated mobile app). The Healthy program applies Social Cognitive Theory (Henriques et al., 2023). It was founded on an interactive technology approach, which served as the theoretical framework (Almulla & Rahmi, 2023). The intervention took into account both behavior and the environment. Setting goals, seeing others, and receiving feedback from self-monitoring apps all influenced one's perception of self-efficacy. However, the effectiveness of specific sets of intervention methods and approaches could be assessed because the type of intervention was determined by the type of intervention group: 1).Providing education on how to monitor activity and eating habits, as well as BMI, 2).Identifying adolescents' abilities to initiate activities and develop expectations regarding the activities they undertake. 3).Identification of physical activity achievement and eating habits, 4).Time management for teenagers to be more active and skilled at managing eating habits, 5).Managing teenage moods to stay active and control eating, 6).Teenagers are allowed to seek support assistance, 7).Self-reward, 8). Teenagers have a positive mindset towards a healthy body, 9).Increased physical activity, and improved eating habits, 10). Use of supportive aids to increase physical activity and improve eating habits, 11). Review the problems faced, and look for solutions, 12). Maximizing the benefits of physical activity, and recommended eating habits, and making sustainable changes. Illustrates the particiant's recruitment flow chat based on the consort diagram on Figure 1.

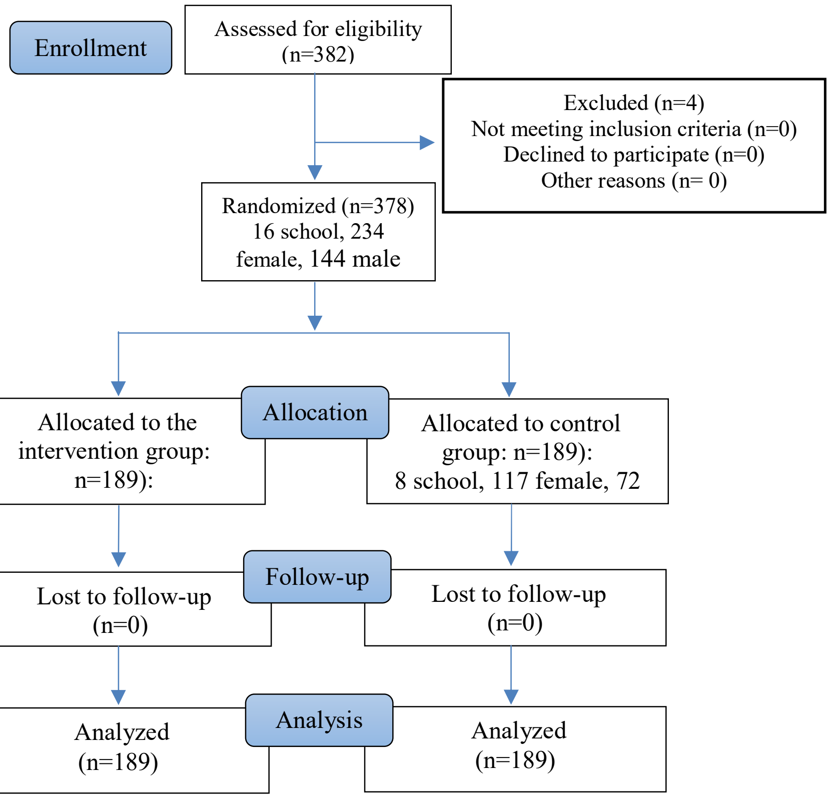

Figure 1. Participant's recruitment flow

The current analyses comprise the 378 teenagers (144 boys and 234 girls) who completed all three survey rounds (Table 1). Approximately half of the adolescents were in the not intervened and comprehensive intervention groups. According to WHO criteria, around 25% of individuals were overweight or obese. This incidence was higher than in cross-sectional studies of similar ages, most likely due to a different cut-off point used to determine body weight status (WHO, 2020; Agyepong et al., 2024).

Procedures and Instrumens

Self-efficacy of Eating Behaviors and personal competences scale

Daily eating habits are associated to self-efficacy in food consumption. The Eating Self-efficacy Brief Scale (ESEBS) measures self-efficacy-based eating behavior. This instrument contains eight indications, notably 1). When you are concerned about employment or studies, 2). When you eat out with friends (for example, at a food stand or a café), 3).

When you experience sadness or depression, 4). When you're with someone who eats the foods you enjoy, 5). When you're really offended and enraged, 6). Events with a lot of food that you may readily grab, 7). When you are nervous for personal reasons, 8). When you are active in the preparation of food. Eating Self-efficacy The Brief Scale is an instrument for measuring eating behaviors based on self-efficacy. This test consists of eight items that assess Eating Self-Efficacy in social and emotional contexts. This test assesses using a Likert scale. Consists of six points ranging from zero ("not easy at all") to five ("very easy"): Previous research have deemed this instrument to be valid and reliable (Lombardo et al., 2020).

Self-efficacy of Physical Activity

The Self-Efficacy for Exercise Scale (SEE) measures teenage physical activity on a daily basis. This instrument consists of nine propositions, namely: 1).The weather is unpleasant, 2).You are dissatisfied with the fitness routine or activity, 3).You get pain while exercising, 4).You must exercise alone, 5).You do not enjoy the exercise. 6).You are too preoccupied with other tasks, 7).You are feeling tired, 8).You are stressed (9).You are quite unhappy (depressed). These sentences illustrate the hurdles that teenagers may experience, with ten response possibilities ranging from 1 to 10, with higher numbers indicating greater confidence in overcoming obstacles. The score is the average of the nine responses. Several countries have demonstrated the instrument's validity and reliability, including Hong Kong (Liang et al., 2014), Australia (Hamilton et al., 2017), China (Ren et al., 2020) Greece (Efthymiou et al., 2022), and Indonesia (Arovah, N. I, and Heesch., 2022).

Body Mass Index

Before the intervention, school nurses measured pupils' height and body weight. People were classified using WHO standards based on their BMI (Liao et al., 2024). For the study, the BMI variable was recoded into two body weight status categories: (1) adolescents with higher body weight. and (2) non-higher body weight. (which included other categories). The weight measurement instrument uses a scale with a capacity of 120 kg, and the height measurement instrument uses a stadiometer with a capacity of 2 meters. Before measuring BMI, the instrument is calibrated to ensure accurate results.

Statistical Analysis

The t-test (Independent t-test) and Mann Whitney were used to compare baseline differences between control and treatment groups. In this study, the T-test is utilized to analyze normally distributed data such as Food Habits Self-efficacy. Mann Whitney is used to evaluate non-normally distributed data, such as percentile body mass index and physical activity self-efficacy. If the results of the analysis are $p>0.05$, it means that there is no difference between the variables in the control and treatment groups. After determining that there is no difference between the control and treatment groups in the baseline data, the analysis is extended to determine whether there is a difference between the control and treatment groups 12 weeks after the intervention. At this point, the t-test (paired sample T Test) is used.

This approach is used to compare the pre- and post-intervention pairs in the control and treatment groups. The Wilcoxon Rank Test is used to continue the analysis once the findings are known. The purpose of this analysis is to determine the differences that occurred following the intervention. A p-value <0.05 shows a significant difference following the intervention. This demonstrates the effectiveness of the intervention (MacCallum et al., 1996). Furthermore, to evaluate the effect size of the intervention provision for both groups, an effect size (ES) analysis was performed using the Independent t test, followed by Cohen's D analysis to quantify the effect size in both groups. Cohen's d effect size categorizes values as 0.00 (ignored), 0.20 (small), 0.50 (moderate), 0.80 (big), and 1.30 (extremely large) (Lakens, 2013). Data were analyzed using SPSS® version 27.0 (IBM Corp., Armonk, NY, USA) with a significance level of 0.05, with a confidence level of 95% [40].

Results

Participants sociodemographic

Table 1. Comparison of participants sociodemographic (n=378)

Characteristics	**Total * (n=378)**	**Male (n=144)**	**Female (n=234)**	**p-value#**
Teenage Age (years)	15 ± 2	15 ± 2	15 ± 2	0.162
11-14 (early)	179 (47.4%)	68 (47.2%)	112 (47.9%)	
15-18 (middle)	199 (52.6%)	76 (52,8%)	122 (52.1%)	
Body mass index				0.134
Non Overweight	171 (45.2%)	55 (38.2%)	114 (48.7%)	
Overweight	207 (54.8%)	89 (61.8%)	120 (51.3%)	
Family history of obesity				0.152
Yes	152 (40.2%)	50 (34.7%)	102 (43.6%)	
No	226 (59.8%)	94 (65.3%)	132 (56.4%)	
Duration of time for physical activity/sports				0.112
< 60 minutes/day	288 (76.2%)	104 (72.2%)	184 (78.6%)	
≥ 60 minutes/day	90 (23.8%)	40 (27,8%)	50 (21,4%)	

Notes: Chi Square Test; Sig: $p>0.05$

Table 1 shown that male and female adolescents had an average age of 15±2 years. According to the baseline statistics, female adolescents with higher body weight in this study were 61.9% more than male adolescents. According to the study results, 43.6% are related to primary or genetic risks, but secondary hazards (poor lifestyle habits) are more prevalent at 56.4%, with a high risk of non-recommended physical activity at 78.6%. However, the results of the study shown from the sociodemographic survey including age, body mass index, family history of overweight, and physical activity of adolescents based on gender did not differ ($p>0.05$) or were homogeneous, therefore it was continued to the analysis of baseline self-efficacy of physical activity and eating habits in adolescents in the intervention groups and those not given intervention using two parametric analyses, namely the T-Test and non-parametric (Mann Whitney).

Self-Efficacy physical activity and eating habits

Because the data was normally distributed and the others were not, each variable requires a unique analysis. Furthermore, to determine whether there is a difference before the intervention (pretest) and after in both groups (control and treatment), effect size calculations for all variables were performed using parametric analysis, specifically the Paired T Test. Table 2 showen the statistical analysis results at the commencement of the program and 12 weeks afterward.

Table 2. Comparation of self-efficacy before and after the Healthy Me program (n=378)

Variables	Time	Not intervented Mean ± SD	Intervented Mean ± SD	p	Effect Size
Physical activity self-efficacy					
	Pre-test	3.29±1.62	3.08±1.62	0.433	0.14 (-0.25-0.53)
	Post-test	3.42±1.59	7.53±1.65	0.000	-2.53 (-3.05-2.01)
	p	0.028	0.000		
	Effect Size	-0.30 (-0.58-0.02)	-2.17 (-2.67-1.66)		
Self efficacy of eating habits					
	Pre-test	2.07±0.97	2.31±1.12	0.157	-0.23 (-0.62-0.16)
	Post-test	2.12±0.96	4.55±0.97	0.000	-2.52 (-3.04--1.99)
	p	0.017	0.000		
	Effect Size	-0.35 (-0.63--0.06)	-1.75 (-2.19--1.31)		
Overweight					
Percentile	Pre-test	95.46±2.81	94.89±3.17	0.373	0.19 (-0.20-0.57)
BMI	Post-test	95.42±2.95	89.39±6.99	0.000	1.13 (0.70-1.54)
	p	0.629	0.000		
	Effect Size	0.01 (-0.26-0.29)	1.20 (0.83-1.55)		

Notes: **T Test; Wilcoxon Rank Test Sig p<0.05; Effect Size (Cohen's D)*

Table 2 shown that the intervention group increased in all variables at the posttest compared to the pretest, with effect sizes ranging from 1.75 in eating habits to 2.17 in self-efficacy related to physical activity. The control group, on the other hand, exhibited an increase from pretest to posttest in the physical activity variable (ES=0.45), in self-efficacy linked to physical activity (ES=0.30), and in self-efficacy related to eating habits. However, the rise in these three variables in the control group was less than that in the treatment group, with increases of 1.75 and 2.17 in physical activity, self-efficacy related to eating behaviors, and self-efficacy linked to physical activity. It may be concluded that improvements occurred in more variables and had a bigger impact size in the intervention group than in the control group.

Table 3. Comparison of adolescent physical activity related to pre-posttest self-efficacy between the non and intervention groups (n=378)

Physical activity Self efficacy items*	**Not intervented (n=189)**		**Intervented (n=189)**	
	Pre	Post	Pre	Post
SEE#1 The weather is not pleasant				
a. Not confident = score 1-5	189	189	168	23
b. Very confident = score 6-10	0	0	21	166
SEE#2 You feel bored with the sports program or activity				
a. Not confident = score 1-5	173	164	170	20
b. Very confident = score 6-10	16	25	19	169
SEE#3 You feel pain when exercising				
a. Not confident = score 1-5	161	159	156	29
b. Very confident = score 6-10	28	30	33	160
SEE#4 You have to exercise on your own				
a. Not confident = score 1-5	121	123	152	40
b. Very confident = score 6-10	68	66	37	149
SEE#5 You don't enjoy the sport				
a. Not confident = score 1-5	146	150	159	42
b. Very confident = score 6-10	43	39	30	147
SEE#6 You are too busy with other activities				
a. Not confident = score 1-5	142	143	138	53
b. Very confident = score 6-10	47	46	51	136
SEE#7 You feel tired				
a. Not confident = score 1-5	139	140	158	35
b. Very confident = score 6-10	50	49	31	154
SEE#8 You feel stressed				
a. Not confident = score 1-5	153	156	162	38
b. Very confident = score 6-10	36	33	27	151
SEE#9 You feel very sad (depressed)				
a. Not confident = score 1-5	148	141	143	50
b. Very confident = score 6-10	41	48	46	139

*Notes: *instrument: Self efficacy for exercise (SEE)*

Table 3 shown that the treatment group increased its physical activity in relation to self-efficacy. This rise is evident in the intervention group's improved responses to the statement questions in Self-Efficacy for Exercise (SEE).

Table 4. Comparison of adolescent eating habits related to pre-posttest self-efficacy between the non and the intervention group (n=378)

Eating habits Self-efficacy items*	**Not intervented (n=189)**		**Intervented (n=189)**	
	Pre	Post	Pre	Post
ESEBS#1 When you are worried about work or study				
Very not easy = score 0	48	46	34	0
Not easy = score 1	45	48	33	13
Less easy = score 2	43	47	48	23
Quite easy = score 3	21	24	49	28
Easy = score 4	12	8	19	40
Very easy = score 5	18	4	6	85
ESEBS#2 When you eat out (e.g. food stalls, cafes) with friends				
Very not easy = score 0	43	45	36	2
Not easy = score 1	58	53	32	10
Less easy = score 2	27	36	44	25
Quite easy = score 3	26	20	35	40
Easy = score 4	16	14	13	28
Very easy = score 5	19	21	29	84
ESEBS#3 When you feel sad or depressed				
Very not easy = score 0	50	47	44	4
Not easy = score 1	42	43	47	21
Less easy = score 2	39	29	36	14
Quite easy = score 3	27	34	27	28
Easy = score 4	19	20	21	44
Very easy = score 5	12	16	14	78
ESEBS#4 When you are with someone who eats the food you like				
Very not easy = score 0	48	47	51	2
Not easy = score 1	41	44	40	23
Less easy = score 2	37	39	37	34
Quite easy = score 3	26	24	26	30
Easy = score 4	18	19	20	32
Very easy = score 5	19	16	15	68
ESEBS#5 When you are very upset and angry				
Very not easy = score 0	41	44	42	5
Not easy = score 1	52	49	53	35
Less easy = score 2	44	38	41	33
Quite easy = score 3	27	25	28	35
Easy = score 4	16	14	18	36
Very easy = score 5	9	19	7	45
ESEBS#6 An event where there is a lot of food and you can easily grab it				
Very not easy = score 0	49	50	48	3
Not easy = score 1	42	48	52	37
Less easy = score 2	40	37	41	38
Quite easy = score 3	30	28	22	36
Easy = score 4	19	17	16	42
Very easy = score 5	9	9	10	33
ESEBS#7 When you are nervous for personal reasons				
Very not easy = score 0	51	47	52	9
Not easy = score 1	40	38	31	20
Less easy = score 2	35	36	27	32
Quite easy = score 3	32	30	36	47
Easy = score 4	17	20	21	42
Very easy = score 5	14	18	22	39
ESEBS#8 When you are somewhere you are involved in preparing food				
Very not easy = score 0	53	49	48	11
Not easy = score 1	47	46	47	30
Less easy = score 2	34	39	36	39
Quite easy = score 3	24	23	30	42
Easy = score 4	19	20	17	34
Very easy = score 5	12	12	11	33

*Notes: *Instrument: Eating Self-efficacy Brief Scale (ESEBS)*

Table 4, that overall the eating habits of adolescents related to pre-posttest self-efficacy between the control and treatment groups improved in the intervented group. This improvement is known from almost all statement items in the ESEBS chosen by respondents in the intervented group more often as "very easy". While the answers in the not intervented group did not experience any improvement.

Discussion

In this study, we hypothesized that adolescents enrolled in the Healthy Me intervention program also have mobile phones as part of a reminder for program implementation. There may be improvements in adolescents' physical activity self-efficacy and eating habits which ultimately increase recommended physical activity and eating habits among adolescents with a correlation to their weight improvement. The fact that our intervention was directed at the entire community of adolescents, both boys and girls aged 15 years—a demographic chosen because of the marked decline in health-related behaviors in this age group, in addition to being shown from the risk of adolescents with higher body weight results from national, physical activity and eating habits that have not been recommended (Ministry of Health of the Republic of Indonesia, 2023), therefore it is interesting to study more deeply with the implementation of the Healthy Me program intervention which has components for improving self-efficacy of physical activity and eating habits. By improving this self-efficacy, it is hoped that it can increase physical activity and improve eating habits among adolescents so that it results in improvements in their weight. Adolescents with higher body weight have the potential to participate in the program because it has positive benefits for them (Morela et al., 2019; Issel et al., 2021). One thing to consider is the detrimental effects of developmental variables. In addition, the rate of change in longer programs may be influenced by some temporary measures, promotion of the program before its launch, overlap with other parallel trends, or adverse effects of program termination. Considering developmental factors and the increasing trend of unhealthy behavior in older adolescents, as reported in other studies, the lack of significant positive changes in self-efficacy improvements, however, the implementation of an intervention program for ages around 15 years is considered to have good results (Inhcley et al., 2017).

Physical Activity Based on Self Efficacy

This study has found that adolescent physical activity based on self-efficacy when the posttest was carried out in the control group, and the treatment showed a difference (p=0.000; ES=-2.53 (-3.05--2.01)). The ES value is in the very large category. This shows that after the posttest there was an improvement in adolescent physical activity based on self-efficacy with ES=2.53. The results of this study are in line with the study in Iran with overweight and obese female subjects aged 30-59 years, a total of 326 treatment groups and 224 controls, who reported that improving physical activity based on self-efficacy can increase physical activity (p=0.013; M=50.16; SD±19.80) with a study duration of 3 months (Nazari et al., 2020). This study is also in line with the research in Australia on overweight (Dewar et al., 2012), and obese adolescents aged 13.6±1.2 years with a total of 357 participants, found that adolescent physical activity increased with an improvement in self-efficacy of 3.60 (3.00-4.20) and research in Spain on 1390 participants (Planas et al., 2019). Similar research results were also reported in Greece on adolescents aged 12-17 years with 1610 participants (680 males, 930 females) namely p=0.001 and an average of 84.93±19.82) (Efthymiou et al., 2022). This study uses the Healthy Me Program approach, namely respondents are given illustrations of ideal/hopeful body models by providing examples of models who have succeeded in achieving their ideal weight through a series of strong self-confidence, improving physical activity habits that have not been recommended in order to get the desired results (Badr et al., 2017; Hynynen et al., 2016). Along with this, efforts to increase adolescent confidence to increase their physical activity to gather with friends, socialize outside the home are in line with the research results in Italy (Di Renzo et al., 2020), and in Israel (Hadar-Shoval et al., 2022).

The improvement in physical activity in the control group is likely due to improvements in self-efficacy related to physical activity in the control group, although this improvement was not as good as in the treatment group. This is known from the comparison of ES self-efficacy related to physical activity in the control group, which is 0.30 and ES treatment is 2.17. Posttest in the control group (p=0.028; ES=-0.30 (-0.58--0.02)). The ES value is in the small category. This shows that there has also been an improvement in physical activity based on self-efficacy in the control group. The potential for improvement that occurs in the control group because the COVID-19 condition has begun to be controlled, so that both adolescents in the control and treatment groups have begun to experience increased physical activity based on self-efficacy.

Self efficacy Based Eating Habits

This study found that after the posttest, self-efficacy related to eating habits in the treatment group improved with ES 2.52. The ES value is in the very large category. This means that eating habits based on self-efficacy have improved by 2.52. The results of this study are in line with the research on 3,531 Korean children (1,708 boys, 1,823 girls), who reported that good self-efficacy in overweight and obese children can improve eating habits in boys by an average of 12.1±2.4 and girls by 12.1±2.2 (Ha et al., 2016). Research in Korea on 215 students found that good self-efficacy can improve eating habits by 0.30 times (p=<.001) (Kim & Yun., 2017). Healthy Me Program, fosters positive beliefs that adolescents are able to realize good hopes, and believe that with good hopes it can be realized. This self-confidence with a strong desire can gradually consume vegetables and fruits as part of the program's success indicators. Similar research results were also reported in

Greece on adolescents aged 12-17 years as many as 1610 participants (680 males, 930 females), improving self-efficacy improves adolescent eating habits by an average of 102.50±21.93 and p=0.001 (Efthymiou et al., 2022). Other research in Indonesia (Makassar) on overweight adolescents aged 11-15 years with 172 participants (61 males and 111 females) also reported that improving self-efficacy can improve eating habits among adolescents by an average of 10.1±2.4 (Hidayanty et al., 2016).

This study also found a difference between pre- and posttest in the control group (p=0.017; ES=-0.35 (-0.63--0.06)). The ES value is in the small category. This indicates that there has been an improvement in eating habits based on self-efficacy in the control group, but the effect is very small. Improvement in physical activity based on self-efficacy in the treatment group is better than in the control group. This is known from the ES comparison between the control and treatment groups (ES=1.75 (-2.19--1.31). However, the improvements that occurred in the control group were because the COVID-19 conditions had begun to be controlled, so that both adolescents in the control and treatment groups began to improve their self-efficacy related to eating habits. The results of this study are in line with the research in Spain in children aged 8-14 years with a total of 899 respondents, the number of males 46.2% and females 53.8%, reported that there was an improvement in eating habits during the COVID-19 pandemic due to an improvement in self-efficacy of 0.09 (0.05-0.12), and p=0.007 (Villodres et al., 2021). The results of this study are also in line with the research in China on 441 respondents, that during the period of social restrictions due to COVID-19 self-efficacy as a good tool for evaluating Chinese people in overcoming negative emotions so that the quality of food consumed is maintained (β=-0.132; p=0.022). Likewise with social restrictions, even though the economic conditions are low, with improvements in self-efficacy, it is able to maintain healthy eating habits (β=-0.019; p<0.05) (Jiao et al., 2022).

One of the best methods to change children's health behaviors related to food and/or physical exercise is the self-efficacy building technique, which is based on the Social Cognitive Theory (Flynn et al., 2022). Promoting healthy behaviors and choices in children's lifestyle can be facilitated by healthy lifestyle interventions that involve the development of cognitive behavioral skills (Siembida et al., 2020). According to Morano et al. (2016), programs aimed at reducing childhood obesity should focus on the psychosocial correlates of physical exercise(Morano et al., 2020) of which self-efficacy (Baghbani et al., 2023) is an important one. Better decision-making and goal achievement are associated with higher levels of self-efficacy (Cheng et al., 2024). Therefore, adolescents who score well on the self-efficacy scale are more likely to engage in and maintain health-promoting behaviors (persistence and strength dimensions). According to our study, improvements in physical activity self-efficacy and eating habits interacted significantly with increases in physical activity and improvements in their eating habits. This study provides ample evidence of the well-established and thoroughly proven mediating function of self-efficacy and other social competencies in the process of changing health habits. Specifically, based on Goffman's theory of shattered identity (Faulkner & Lusher, 2024), and additional randomized controlled trials investigating the impact of stigma on health behaviors (Pudneya et al., 2020), with regard to overweight and obesity, obesogenic behaviors in children are more common in those with inadequate social skills. A national American sample was used to validate the interaction, which showed that children with lower social competence at age nine were more likely to be overweight or obese by the time they were eleven years old (Sutter et al., 2020). The low social competence group may exhibit unhealthy behaviors such as eating poorly or isolating themselves to cope with the stress caused by complex psychosocial problems and negative feedback associated with being higher body weight (Flores et al., 2023).

Conclusions

In conclusion, this randomized controlled trial demonstrated that a series of self-efficacy-based educational interventions to promote physical activity and healthy eating in overweight adolescents within a 12-week intervention program effectively improved physical activity self-efficacy and healthy eating habits in overweight adolescents. The treatment group showed significant increases in physical activity self-efficacy and healthy eating habits compared to the control group after the self-efficacy-based educational program intervention. Although the control group also showed improvements at the end of the 12 weeks, these increases were smaller. This underscores the importance of self-efficacy-based education in achieving improvements in physical activity and healthy eating habits. Therefore, enrolling overweight adolescents in such programs is recommended to improve physical activity and healthy eating habits in adolescents. Future research should consider longitudinal studies, comparative trials, and a multicenter approach for a comprehensive understanding.

Conflict of Interest:
The authors declare no conflict of interest.

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